

AVIATION

The Oldest American Aeronautical Magazine

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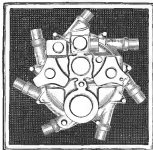
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National Adoption

ACCORDING to reports the army meteorological experiments now being conducted in California by the Guggenheim Foundation for the Promotion of Aeronautics are proving largely successful as regards the development of a weather reporting system which is accurate, dependable and worthy of aerial adoption. This work, however, is just what it was originally intended to be—a series of experiments to ascertain the most effective way to report weather conditions existing along an airway, and naturally the experiments will not be considered haphazardly.

Therefore, unless something is done to induce the Government to bring about a national adoption of the system perfected by the Guggenheim Foundation, aviation operators will be forced to continue with the present system of weather reporting which is totally incomplete and inadequate for the purpose it should serve. The only other alternative for the progressive airline operator to follow, at the termination of the Guggenheim experiment, would be the individual adoption of the system on his own particular line. Such proceeding would not only be costly but wasteful due to the possibility of duplication and overlapping lines. In addition, there might arise the element of competition in the matter of obtaining weather reports, and that is something which should be absolutely avoided. Adequate weather reporting is but a safety precaution in the operation of an airline, and every airline, regardless of size or financial standing, should have access to the best weather reports obtainable, just as every single ship on the high seas has access to all marine weather reports.

The manner in which government adoption of the Guggenheim weather reporting system should be utilized is something to be decided in the near future. A routine appeal of all airline operators might prove fruitful, or perhaps a combined appeal of the entire industry would bring forth the desired results. For the Government to reluctantly adopt the Guggenheim system would not be subsidizing American aeronautics any more than the maintenance of a marine weather reporting system is subsidizing American shipping. And for that matter, there is no necessity of the Government subsidizing the entire enterprise. Some arrangement could be made whereby each airline operator could pay a proportionate share of the cost of the organization and maintenance of the system over his particular line.

However, such details can be worked out easily enough. The fact remains that the Guggenheim Foundation for the Promotion of Aeronautics has, of its own volition, conducted a series of weather reporting experiments, the results of which are worthy of national adoption. Let this organization, as a board would be a most pronounced setback for American aeronautics in the struggle against its greatest enemy—the elements.

Taxi Business

DURING the Summer and Fall of 1927 aerial taxi companies all over the country reaped a golden harvest in "joy hopping" the public at so much per hour. It was a popular sight on Sundays and holidays to see hundreds of men, women and children flocking about the planes on an airport or flying field, each anxious to experience the thrill of a five minute hop about the field. To take one of the then seemingly increasing amount of business many of the aerial taxi operators sought additional planes. The business did increase and the amount of profit made on some days was almost unbelievable.

However, all good things eventually come to an end, and although the golden harvest continued for awhile at the beginning of this year, with the coming of Summer the joy hopping business took a most decided slump. To encourage a revival, prices were gradually reduced to a point where hops were made almost at a loss. The result is, that many taxi companies have more planes than they need for the joy hopping business that exists.

At first glance this might be considered an alarming condition, but, according to operators who reaped the golden harvest and are still in business, while there is a decrease in short hops for pleasure there is an increase in long flights for business reasons. In short, the public is beginning to patronize the most modern means of transportation because it is so swift in every day life.

Long flights would seem to be the best kind of business for aerial taxi companies to solicit. The whole joy hops may bring abundant profits imperiously, long flights go toward building up a clientele that will produce repeat business, which, after all, is the best kind of business. For the present, however, it might be advisable for the taxi operators to concentrate on organizations rather than individuals. The cost of a long flight is not within reach of the man of average means, and will continue to remain so until the well known element of production brings it down to fit his pocketbook. On the other hand, it will worth the cost to an organization if its officials and executives can be transported from one spot to another at short notice and in the least possible amount of time.

To obtain this type of business, calls for the inauguration of educational advertising campaigns, direct or otherwise. Conveying presentations of the advantages of using the facilities of aerial taxi companies will as it is called airline cannot be used have converted many business and fraternal organizations in the past, and there is no reason to believe why a concentration on the thousands yet to be converted would not produce most satisfying results. For these aerial taxi operators who seek the knowledge of how to go after such business there are many individuals and advertising agencies who have studied the aeronautical industry, and the best methods of selling the passages of other industries.

The Cierva Autogiro

Some Interesting Information Regarding the Aerodynamic Principles Involved in the Design and Operation of This New Craft

By W. H. SAYERS

Technical Editor of "THE AEROPLANE"

THE Cierva Autogiro, which has attracted a great deal of interest in Europe during the past few years and will probably attract such attention in America when it appears among the competitors in the Guggenheim Safety Competition, is an aircraft which stands in a class by itself.

It is not an airplane but it has a rotating system of supporting surfaces in the place of wings. It is not a helicopter for this rotating system is not driven by the engine's power plant but is merely carried on free bearings and kept rotating by air forces alone.

Apart from the "rotating wing" system the Autogiro resembles the conventional tractor airplane in practically every respect. It is fitted with a normal type of engine driving an ordinary propeller. All the Autogiros as yet built have a standard airplane fuselage, landing gear and tail unit. The controls used are similar to those of the airplane except that ailerons, which cannot be carried on the rotating wing, are separate organs carried on each side of the fuselage by a structure specially provided for this purpose.

The Need of Long Development

This type of machine is the result of a long process of development by Señor Juan de la Cierva, Spanish engineer, whose experiments with gliders and power-driven aircraft between 1911 and 1918 had convinced him of the importance of discovering new method for supporting heavier-than-air flying machines which did not make necessary the attainment of a high forward speed, and which was not subject to the danger of stalling.

The possibility of using rotating vanes for this purpose was early recognized, and the first Autogiro, built some time about 1920, was provided with two sets of rotating vanes, one above the other, which were to be kept in rotation in opposite senses by air forces alone. Unfortunately, owing to interference between the two vanes, the lower vane refused to turn at more than two-thirds the speed of the upper.

When a machine with such rotating wings is in horizontal movement, the blades at one side have a total air speed which is the sum of the rotational speed of the vane, and of the horizontal speed of the machine. On the other side the blades have a total air speed which is the difference of these two speeds. Hence the air forces on the two sides are not in general in balance. The use of twin rotating systems was resorted to overcome this lack of balance, and the failure of the vanes to rotate at equal speeds delayed this object.

The next Autogiro had but one rotating wing system and was fitted with a control whereby the pilot was able to vary the relative angle of incidence of the blades during their rotation so that each blade could be given increased incidence where its air speed was low and vice

versa, thus securing the required balance of lift. This arrangement proved inadequate to its intended purpose.

A number of other attempts to produce equilibrium control systems failed because the out-of-balance forces proved to be unexpectedly large, and because of the enormous inertia of the rotating wing system.

Finally, Señor de la Cierva arrived at the simple and entirely satisfactory method of overcoming this inherent lack of balance which is the distinctive feature of the



Showing the mounting of the rotary wing system of the Cierva Autogiro. Señor de la Cierva, the inventor, is in the foreground seated. (Picture was taken just before the recent London to Paris flight. (London News Photo).)

Autogiro of today. Each blade was hinged freely to the bearing above which the whole system rotated in such a manner that it was free to fold upwards or drop downwards within wide limits.

When the system is rotating, centrifugal force tends to keep the blades horizontal. Any lift forces on the blades will deflect them upwards from the horizontal and they will be at an angle, which depends on the relative magnitude of the lift and the centrifugal forces, such as to produce equilibrium.

If centrifugal forces are large in comparison with the lift forces, as they are in fact, the position of equilibrium will not be far removed from the horizontal. Now because the blade is freely hinged at the root, no moment caused by the lift forces will be transmitted through the hinge, which can transmit to the main frame of the machine only the vertical and horizontal components (lift and drag) of the total forces acting on the blade.

Thus even if the lift on a blade at one side of the machine were very much greater than that on the oppo-

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site blade, the moment tending to cause the machine to roll over is only the product of the difference between the lift on the two sides multiplied by the radius of the huge cones from the centre line of the machine. This radius can be kept very small, therefore the moment itself cannot be large.

But there is another result of this hinged blade system. Consider a single blade momentarily lying parallel to the direction of flight of the machine, and with its tip pointing backwards. There is no component of horizontal air speed along the chord of this blade caused by movement of the machine, and its lift therefore depends on the air speed caused by rotation alone and on its angle of incidence.

But as it rotates this angle of incidence changes and a steadily increasing component of the forward air speed of the machine is added to the air speed of rotation. The centrifugal force on the blade is caused by the rotation alone and does not change in magnitude. Therefore while the lift is thus increasing, the angle of equilibrium between lift and centrifugal force changes, and the blade is forced upwards. But any such upward movement of the blade means that its angle of incidence to the air is decreased thereby.

Consequently, when the blade passes a position at right angles to the line of flight, the added component of air speed over the blade caused by the forward speed of the machine decreases. The lift also decreases, the blade tends to drop and thereby increases its angle of incidence.

The total result is that the blades in addition to rotating also move up and down, or dip, and by so doing change their incidence in a way which tends to keep the lift on each blade constant.

The rotating wing system used on the Autogiro consists of a hubber, usually made of blades each built on a single metal tube spar. These blades are of a mirror-symmetrical section, either of the symmetrical type or with a reflexed camber giving a stationary centre of pressure, so that the main spar is not subject to serious torsional loads. Each spar root is connected through a horizontal hinge to a central block which runs on ball-bearings on a main projecting above the fuselage of the complete machine. The attachment of the blades is such that each is given a small positive angle of pitch as measured from the axis of the mast.

Cables, in which shock absorbers are incorporated, are

attached to the blade spars and to a roller at the top of the mast which is free to rotate with the blades. These cables serve only to prevent the blades from folding right down when the machine is stationary. In practice it is desirable to allow a certain degree of free movement of the blade in the plane of rotation in order to relieve the structure of the fluctuating loads imposed on rotation.



— View showing the method of "winching up" the blades on an early model of the Cierva Autogiro.

vertical blades. This is achieved by using a secondary hinge and a system of cables between blades which will be described later.

Thus apart from the hinges at the blade roots the rotating wing system is mainly a large diameter anti-bladed propeller of free pitch.

The axis of the mast about which the whole rotating system revolves is inclined backwards a few degrees to the normal line of flight of the machine.

When therefore the machine as a whole is moving forward the horizontal air flow may be considered in relation to the rotating vanes as compounded of a large component in the plane of the blades and a small component up through the blades. It is this component of the air flow up through the blades that keeps the whole system rotating.

At first sight it would seem that such an upward component of flow in conjunction with the positive setting (Continued on page 1341)



The Cierva Autogiro, Type C.8.M. II in the air near Newcastle, England, during the 1928 race for the King's cup.

True Altitude Meters

A Record of the Experiments Conducted and the Results Obtained in the Development of an Accurate Altimeter

By LAWRENCE A. HYLAND
Radio Engineer

THE outstanding problem of both the military and commercial air services is—the development of means and mechanisms which will permit safe flight in fog or adverse weather and which will enable a landing to be made under such conditions at the conclusion of the flight.

The problem may be divided into three general parts: First, direction finding and field location; second, stability indication; third, altitude indication.

Recent years have seen much progress in both direction finding and stability indicators. The radio compass, radio beacon and indicator compass have been developed to the point of immediate and reliable application. Improvements in turn, bank and climb indicators have made instruments flying predictable and safe after suitable preliminary flight instruction for the pilot.

Altitude indicators, however, have had no major improvements incorporated in their design for many years. All standard types rely on the barometric principle and are subject to the inaccuracies and serious limitations inherent in atmospheric pressure gauges.

While few public measurements have been made, there have been, nevertheless, many barometric and aneroid readings original in research looking to the development of a true altimeter, i. e., one which would indicate the height of the aircraft over the ground regardless of the weather. The lines of attack have been as varied as the num-

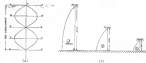


Fig. 1. (a) A graphical representation of one wavelength of a radio wave. (b) A diagram showing how the 8,000 ft. wavelength may be used. At the left, the aircraft is flying at 2,000 ft., or a quarter of the wavelength above the earth, over the shorter range maximum. The other diagrams show the aircraft at lower altitudes and the reduced wave readings.

ber of research workers and widely differing reports have been made as to the success of the several experimental methods. This article will review briefly the various methods and the results obtained with each to date.

The pursuit of a true altimeter has led to the investigation of mechanical, electrical and acoustic systems. Under



A photograph of the control bar and indicator of the Gross landing altimeter.

artificial conditions a fair determination of true altitude can be obtained by mechanical means. In general the procedure is to time the fall of an object from the aircraft to the ground. Smoke pots or torpedoes are the missiles employed and a stop watch or similar device does the timing. With smoke pots it is necessary to use the ground in order that the burst may be observed while the torpedoes require that the aircraft be in a glide with the engines idling in order that the sound of the explosion reach the ears of the aerial observer. Obviously the scheme has only a limited application, it is of no worth when landing and appears to have no possibilities worthy of development.

The measuring of altitude on aircraft by means of acoustic instruments has received considerable attention from scientists throughout the world. The most intensive development of this type altimeter has taken place in Germany under the leadership of Dr. Behn, who has adapted his machine sonic depth finder to the special needs of aircraft. The Behn altimeters are of two kinds but have the same guiding principle and are typical of acoustic altitude measuring apparatus.

The most possible of the two instruments makes use of a source of sound such as a pistol shot or a short sharply defined pulse tone directed, as near as possible, toward the earth. The sound is reflected from the earth and the reflection or "echo" is picked up by the receiving apparatus aboard the aircraft and supplies the energy to deflect a beam of light. Ordinarily the light beam runs at the zero portion of a scale. At the instant of the pistol shot, however, a firing wheel is mechanically released and slowly revolves, causing the beam of light to advance along the scale. When the deflection of the beam on the altitude is read directly off the scale at the point of deflection. Tests made with the instrument under labo-

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ratory conditions have indicated an accuracy to within a few inches. Successful service tests were made on the duplicate 235 (now the U. S. S. "Los Angeles") during the ship's trials in Germany. This type of altimeter was also installed on a Lufthansa passenger plane and extensive tests were made to determine the practicability of the apparatus for airplanes. It was found that with properly installed engines, "soundings" of fair accuracy could be made up to 150 ft. while much greater altitudes were possible with the engines idling and the plane in a glide.

An interesting feature of the Behn instrument is found in an intricately sonic levelled rest to the altitude scale. By noting the slowness of the echo the receiver drum that continuously may be drawn as to the character of the return below.

The second form of the Behn acoustic altimeter differs in a manually operated timing device and reception by ear. While such less accurate than the automatic instrument, it has the advantage of less complication, lighter weight and (theoretically) offers a better chance to determine the character of the ground underneath by observing the peculiarities of the echo by ear. It would appear that this last feature of the Behn altimeter has been greatly overrated, for the determination of the qualities of an echo to the end that a reasonable guess may be made as to the composition of the reflecting surface, requires long experience, concentration and quiet surroundings, conditions not normal to fighter-bomber craft. Actually this second model of the Behn altimeter differs from the mechanical systems described below above only in that the sound making explosion takes place above the aircraft. Hence more noise is required for the same altitude.

The primary defect of these altimeters is, of course, the lack of continuous height indication. While Dr. Behn claims that his apparatus will take soundings every second or half second, the fact remains that for landing purposes or in situations flying the instrument should give the instantaneous value of the altitude. The operation of this condition would demand cartridge explosives with almost machine gun rapidity over considerable lengths of time prior to a landing. The constant firing the acoustic system seems to have no value. Altitudes could be read equally well and the airplane may be safer danger from a machine ahead, while the best sounding value taken as quickly as possible, but nevertheless delayed by the required time for echo travel, may indicate that the plane has several hundreds or thousands of feet altitude.



would demand virtually the whole attention of the pilot if the apparatus were to be of value at all. Yet at the very time when such attention is required the pilot is in a situation demanding all of his faculties and can spare none for the most daring planes at the altimeter.

The accuracy of the acoustic type instrument is constant with increase in altitude up to the limit of the instrument. This is an improvement over the accuracy characteristic of the barometric type instrument, which is usually more accurate at the altitude extremes. The ideal condition, of course, is far improved accuracy at low altitudes.

Acoustic altimeters may well have application on board dirigibles where lift is independent of speed, where engine noises are not present and where sufficient personnel

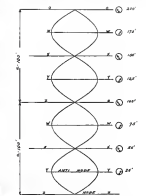


Fig. 2. A drawing illustrating the action of a short wave altimeter. Note how the wave reading changes from maximum to minimum every 25 ft.

can be had to operate the device without detracting the attention of the pilot. On airplanes, though, it would seem that a continuously acting automatic device of extreme simplicity is required and none of these features is found in the acoustic apparatus.

The electrical art has offered a rich field for investigation seeking a true altimeter. Nearly all of the efforts have involved the adaptation of radio circuits and phenomena. One of the earliest attempts to make an electronic altimeter proposed to utilize what is called a standing wave. This system may be better understood by referring to Fig. 1. In (a) is shown a diagram of a radio wave. It will be noted that in a complete wavelength the wave starts at O, rises to a maximum at WW, becomes a minimum at XX, rises to another maximum at YY and returns again to a minimum at ZZ. For a given altitude. Further the operation of the acoustic altimeter

The internal mechanism of the amplifier and control units of the Gross electric capacity altimeter.

above the terrain below. Time is of the essence. If shots and readings are taken at too slow a rate the clouds above the earth may change between times, but if the shots are made too rapidly there is the likelihood of overlapping echoes and consequent erroneous altitude indications. Further the operation of the acoustic altimeter

The "Cavalier" Monoplane

*A New Two Passenger Cabin Plane Designed for the Private Owner
Is Powered With a Veeie 45 H. P. Radial Engine*

PRODUCTION on the "Cavalier" cabin monoplane is to be started in the near future by the Star Aircraft Co., Baraboo, Wis. The Cavalier is a two place, externally braced, high wing type of conventional design and is powered with a five cylinder Veeie engine developing 45 hp. at 1750 r.p.m. It is intended primarily to be used for business and pleasure by private owners.

The plane was designed by E. A. Rogg, chief engineer of the company and "Bert" Parker, vice-president and general manager. Successful test flights were held last August and showed the plane to have a maximum speed of 195 m.p.h., a cruising speed of 87 m.p.h. and a landing speed of 38 m.p.h. The rate of climb is 800 ft. per min. and the service ceiling 12,000 ft. During the tests, the plane took off in calm air in 200 ft. and landed under the same conditions in 150 ft. It attained an altitude of 6,000 ft. in 10 min. The plane has a wing span of 23 ft. 6 in., an overall length of 6 ft. 3 in. and an overall length of 10 ft. 6 in. Its weight, with engine and fully equipped, is 740 lb. The useful load is 375 lb.

No departure from standard practice is found in the general construction of the Cavalier. The fuselage and tail group are welded aluminum stress members and the wing structure is of wood. Both are fabric covered. Routed one piece spruce spars are used with simple fillets at all fitting stations and spruce trim ribs with plywood gussets are employed in the wing construction. Knaped Macguyre tie rods are used in the internal bracing. The wing is divided into two panels at a slight dihedral angle. The spars are connected by heavy gauge tubes



Front quarter view of the "Cavalier" monoplane

across the top of the fuselage. These tubes are provided with strong lip fittings to receive the spar ends. They are completely covered by the longerons and are rapidly attached by welding. Two 13 gal. gasoline tanks are built into the wing roots and the drag struts in the bays containing the tanks are carried into the fuselage through diagonal grained plywood panels secured to the front and rear spars and to strong box ribs at the ends of the bays.



A photograph of the left wing panel of the new Star cable monoplane, showing the construction

A heavy tubular diagonal cross brace in the upper bay of the fuselage ties the drag struts and at the same time serves as one of the main members of a cantilever arrangement which eliminates the necessity of cross bracing in the cabin. A similar strut is used as the lower support of the fuselage. Particular attention has been given to the design of the lower fuselage framing, and the cross tubes are of ample diameter and gauge. This is especially true of the front tube, which is subjected to high compression loads.

The wing struts are built up of a number of chrome molybdenum steel tubes of different diameters, welded at the ends, producing a streamline drag section. Nickel steel screw adjustment fittings are employed at the lower ends of the struts and the fuselage struts are of chrome molybdenum steel. A single hole through the spar takes the entire load at each fitting point and is so placed as to eliminate eccentric loading at these points. Another factor, which contributes to the elimination of eccentric loading, is the position of the struts in the same vertical plane as their respective spars. The shear bolts at both wing ends are of government specification nickel steel and are interchangeable.

Standard automobile practice is employed in the interior finish of the cabin, which is upholstered in velvet, and has accommodations for pilot and passenger seated side by side. Controls are brought to the left seat, which is intended for the use of the pilot. Good visibility is provided in all directions. Instruments include a tachometer, oil gauge, oil thermometer, and altimeter. A compass and the shut-off valves for the gasoline line are placed within easy reach of the pilot. Dual controls may be installed.

(Continued on page 1454)

Commander Byrd's Fokker

*Modified Super-Universal Powered With a "Wasp" Engine Is Fitted
With Special Instruments and Equipment*

THE "Wasp" powered Fokker Super-Universal monoplane "The Virginia," which will be used by the third Antarctic Expedition, embodies several modifications in the structure of the production plane of this type. Special instruments and equipment not found in the standard Super-Universal have been added to fit the plane for the extraordinary conditions under which it is to be operated. The principal results obtained by these alterations and additions are increased cruising range and greater comfort and convenience for the operators.

Before it was shipped to the Antarctic last, where it is expected to arrive some time in January, 1936, the Virginia was tested at Mitchell Field in the winter satisfaction of Cmdr. Richard E. Byrd and his pilots. Previously the plane was taken on a 25,000 mi. demonstration tour of the country. The Virginia is the fourth Fokker airplane to be purchased by Commander Byrd for his expeditions. Its predecessors, the "Josephine Ford," the "Anconia" and the "Pittsburgh," have become automatically famous.

The Virginia employs standard Fokker full cantilever wing construction and has a span of 30 ft., 7 in., an overall length of 36 ft., 7 in., and an overall height of 8 ft., 11 in. The plane has a maximum speed of 145 m.p.h., a cruising speed of 110 m.p.h. and a landing speed of 42 m.p.h. The rate of climb is 1,000 ft. per min. and the service ceiling 18,000 ft. Transparent lacquer, revealing the natural color of the wood, is used on the lower wing surfaces while the upper surface is finished in chrome yellow. The fuselage is longer than in Byrd's previous planes.

One of the principal structural changes was made to provide for the installation of two additional fuel tanks, which will provide a cruising range of nearly 2,500 mi. The fuel system consists of four tanks, three of which are built into the wing and the fourth placed on the floor of the cabin. The total capacity of these tanks is 383 gal., allowing twenty-four flying hours at cruising speed. The center wing tank, which has a capacity of 113 gal., is mounted between the wing spars directly above the cabin



The instrument board of "The Virginia" showing the mounting of the instruments for night flying on the narrow panel in the center.

and is connected in series with two 55 gal. wing tanks on each side. Glass gauges are provided in the two outer wing tanks, and they are wired from the outside. The center tank is vented by its connection with the cabin tank, which is so designed that it can be filled while the plane is in flight. A hand pump within easy reach of the pilot forces gasoline from the cabin tank into the center wing tank. A small chain gauge in the return pipe acts as a safety indicator the pilot when the tank is full. Shut-off cocks are provided in the connections between the tanks so that it is possible to operate on the center tank alone, the two outside tanks or all three.

(Continued on page 1350)



Rear quarter view of "The Virginia," Commander Byrd's modified Fokker monoplane.

Regarding Engine Oil Temperatures

By J. H. GUNSE

Staff Aircraft Factory, Philadelphia, Pa.

THIS article is intended to clear up what seems to be a very wide spread misunderstanding of the significance of oil outlet temperatures, or oil temperatures in aviation engines. This misunderstanding is not confined to non-technical operators, but is common also among engineers, due no doubt to lack of analysis of the factors controlling the outlet temperature and temperature rise.

One mistake commonly made is that a high oil outlet temperature, or large temperature rise, is an indication of trouble, or poor design. Sometimes it is; but in many cases it is not. Another mistake is the assumption that the oil outlet temperatures should be approximately the same for all engines and all installations. True and true again I have been asked what should be the limit of oil outlet temperature. My answer is that I do not know.

Undoubtedly, there is a limit for each installation, but for different installations of the same engine, or for different engines, this limit may be any where from 120 deg. F. to 240 deg. F., or even higher. The reason for this wide variation in permissible outlet temperatures is that the outlet temperature bears no direct relation to the temperature of the oil in the bearings, or to the heat generated in the bearings, the two values that do have a definite positive relation to each other. The analysis that is presented in the following paragraph is designed to show why it is such a direct relationship does not exist.

To simplify the analysis, several assumptions will be made, which denote fairly far from actual conditions existing in an engine, but I believe that they will affect only the magnitude of influence of the various factors and not the direction of their influence. The major assumption is that the oil entering the engine is divided into three distinct channels which do not converge until they reach the scavenging pump. One channel will lead to the crankpin bearing, and from there to the pistons and cylinder walls, and will then connect with a section of the crankcase on its return to the scavenging pump. A second channel will lead to the scavenge and main bearings, and contact with a different section of the case on its return. The third channel will lead through the relief valve and the heat exchanger, or, as substituted, from this channel, to the scavenge pump.

When the three channels converge, their temperatures are equalized and the mean then obtained is the oil temperature.

oil temperature. The oil outlet temperature can then be set down in the following equation:

$$T_o = W_1 T_1 + W_2 T_2 + W_3 T_3$$

$$W_1 + W_2 + W_3$$

in which

T_o —outlet temperature.

W_1 —rate of flow in channel No. 1.

T_1 —inlet oil temperature channel No. 1.

W_2 —rate of flow in channel No. 2.

T_2 —inlet oil temperature channel No. 2.

W_3 —rate of flow in channel No. 3 (relief valve).

T_3 —inlet temperature.

Now let us consider the heat interchanges in channel No. 1. The rate of oil flow through the bearing will not naturally change the friction, so it can be assumed that the amount of heat absorbed will be independent of oil flow. This being the case, the temperature of the oil leaving the bearing will be equal to the inlet temperature plus some constant, divided by the rate of flow. This oil will then strike the cylinder walls and pistons. Here, the amount of heat absorbed will increase with increase of oil flow at the expense of heat dissipated by the cylinder cooling means. We will make a rather bold assumption that the temperature of the oil leaving these parts will have a definite relation to the mean temperature and, therefore, the heat unit added to the oil is said to be very directly with the rate of flow.

In passing over the crankcase wall, a certain amount of heat will be dissipated, and the amount will vary as the difference of the oil temperature (assumed constant) and the outside air temperature, the air velocity over the crankcase, the area exposed, and the rate of flow. However, in practically all engines, this loss of heat will not equal the gain. It is obvious, therefore, that there will be a temperature rise in this channel.

It should be noted here that the heat generated in the crankpin bearing will have very little direct effect on the final heat content in this channel. It will, however, have somewhat of an indirect effect, in that the reduction in viscosity of the oil associated with the higher temperature in the bearing will increase the rate of flow in this channel and there-

fore cause heat will be taken from the pistons. It should also be noted that the temperature of the oil in the bearing is not related directly to the final temperature in this channel but does have a fairly close relationship to the oil inlet temperature.

Next consider the oil in the second channel. It likewise receives a definite amount of heat from the bearings and the temperature leaving the bearings will be equal to the oil inlet temperature plus a constant divided by the rate of flow. This oil in passing over the crankcase will lose an amount of heat proportional to the difference in the temperature of the oil and the air, the weight of the air velocity, and the rate of oil flow. In any engine operating with no final increase in oil temperature, it is apparent that this oil must accomplish a total dissipation of heat equal to the amount added to the oil in the first channel, since the oil in the third channel has no heat interchange.

An Important Item

Now let us consider the effect of various variables on the oil outlet temperature and the temperature rise. An increase in the rate of flow through the relief valve, without any other change, will reduce the outlet temperature without altering the temperature at the bearings. This is an important item. Engines having a low oil flow through the relief valve, such as the Liberty will have a greater oil temperature rise than engines like the Wright T-3, having a much larger relief flow, other things being equal. Engines like the La Blon, in which the oil from the relief valve goes back to the suction side of the pressure pump, giving an oil in our channel No. 3, will have a greater temperature rise than will a Wright "Whirlwind," if other factors are alike. It is quite apparent then, that these engines will all require different temperatures of the oil inlet in order to secure the same temperature at the bearings.

Again let us assume two air cooled engines alike in all respects, including total rate of oil flow, but with a different rate of flow in channels No. 1 and No. 3. The case, having the greatest flow through channel No. 2 will have the lower temperature rise because channel No. 2 tends to dissipate heat and channel No. 1 to absorb heat. This is an item worthy of special consideration. In most installations of air cooled engines, it is desirable to avoid the necessity of an oil cooler, depending on the radiation from the engine and tank to the side of the heat. It is quite possible that in cases where this has not been achieved, that a slight change in the oil system of the engine allowing a greater flow to the scavenge drive would have accomplished the desired result. It is also possible that oil temperature regulation in air cooled engines might be secured by regulation of the flow in the second channel, thus making adjustable cooling arrangement.

The Effect of Detonation

Another point of interest in this division of flow is the effect of detonation. Although I am not sure, I am inclined to believe that the oil temperature is sometimes used as a guide in the choice of fuels for air cooled engines. It is this is the case, it is evident that this engine involving the constant flow to pressure pump will show the greatest increase in oil temperatures due to detonation and may possibly be considered as more inclined to detonation than an engine less sensitive. On the other hand the engine having the least sensitivity may be saved by the use of a fuel having considerable detonation.

Now let us consider changes that may occur in an engine in service. In an air cooled engine installation lan-

guage no oil cooler, or other means of oil temperature regulation, an increase in bearing clearances in channel No. 2 will result in a decrease in oil temperature. An increase in the connecting rod bearing clearance will result in just the opposite effect, as explained in a preceding paragraph. An increase in oil pressure will increase the rate of flow in both channels No. 1 and No. 2. The result may be an increase, or a decrease, in temperature rise.



Front quarter view of the 200 hp. Wright "Whirlwind" air-cooled radial engine referred to in this article.

To determine which would be the case, would require a closer analysis of the heat exchanges in these channels than I have made. In water cooled engines, it would without question result in an increase, the extent of change being dependent on the relative amount of heat normally taken from the bearings and the pistons. A decrease in viscosity of oil used will act in the same way as a change in pressure.

In engines in which the oil from the relief valve is led to the inlet of the pressure pump, it is quite possible that too low an inlet temperature will result in too high an outlet temperature. This may occur also in engines having pumps, whose capacity varies considerably with viscosity and pressure head. In other cases, the decrease in flow will result in a decrease in total heat taken from the engine. If this decrease is not sufficient to compensate for the lower flow rate, there will be of necessity an increase in temperature rise. If the increase of temperature rise is more than sufficient to balance the decrease in inlet temperature, then a result will be seen that the outlet temperature will increase as the inlet temperature is decreased.

In conclusion I would like to say that although this article endeavored to show that the temperature of the oil at the bearings does not have a definite relation to oil outlet temperature, I do not contend that the outlet temperature has no significance. It has, very definitely, but not to such an extent as some operators are inclined to believe and engineers in it can be analyzed much more thoroughly than has been generally done. A thorough analysis may save a considerable amount of wear and worry for operators of stretch engines.



J. H. Gunse

Reviews

The most interesting aviation title first this fall, *How Fast Can You Go?* by John G. Thompson, is a book of aviation facts and figures, published by the National Gallery (London) for distribution, Washington, D. C.

Myths and Miracles of the Aeronautical Age by (German) Hanser, Munich, Volume IV (Vier) by Hanser Verlag, Munich, is a book of aviation facts and figures, published by the National Gallery (London) for distribution, Washington, D. C.

Report V 375. The induction of the R-10, on the strength of Main Texas State. The rifle wing both main parts of an airplane wing being about a repetition of the lead by which the trailing front and leading elements on the span may be closely adjusted. The report gives theoretical calculations of the influence of the wing. A number of cases are calculated by the theoretical method of velocity.

Report A 133. The Resistance of Airplane Wings. Experiments were made in order to investigate how far the resistance of wings could be diminished by aerodynamic devices such as airfoils, airfoils, and covering up the resistance of the wing and the main parts. It is shown that by smoothing out the air and adding leading the resistance is appreciably decreased.

Report V 375. Mechanical Properties of Some Materials that are Used for the Construction of Airplanes. Steel, wrought iron, aluminum alloys, and fibers for the construction of wings and their strength is studied.

Report A 135. Experiments on the Airplane of a Thick Layered Wing. Report A 136. Air Resistance of Two Airplane Wings.

Report A 136. Further Experiments on the Influence of Boundary Condition in a Wing Section.

Report A 138. Experiments on the Boundary Condition in the Boundary Layer of an Airfoil with Boundary Layer of the Tests in the Boundary Layer of the Airfoil with Boundary Layer of the Tests.

The War in the Air, Volume II, which is a continuation of the story of the Royal Air Force and the men it played in the World War, has just been placed in the market. The author of this volume of the history is H. A. Jones who was selected to carry on the work of the late Sir William Rich, the author of the first volume.

This second volume describes the operations of the British air force through 1918. It is told the story of the war from the point of view of the British air force. It is the story of the British air force from the point of view of the British air force. It is the story of the British air force from the point of view of the British air force.

Flys Waco in Outside Loop

WACO, O.—According to reports at the Advance Aeronautics company here, Freddie Brown, pilot, just added to the firm, recently performed a perfect outside loop in a Sport Waco over the company's test field here. This is said to be the first time such a maneuver has been accomplished in a construction plane. Starting his loop at an altitude of 2,500 ft., Brown dove 1,600 ft. for speed, then rolled over on his back at the bottom of the loop. Brown has made all the way forward, he accomplished the outside loop, which is a loop at all times horizontal flight. Loop also performed a triple inverted roll.

Motion Pictures to be Conference Feature

WASHINGTON, D. C.—Motion picture films brought over by foreign delegates and others obtained from the American Association of Aeronautics and Astronautics, and the American Society of Aeronautics, will be shown at the Washington Aeronautics as part of the program devoted to aeronautical history at the International air conference, scheduled here December 12-14. The public will be invited to the showing of the motion picture.

Present at the conference and participating in this program will be many of the men who actually took part in pioneer flights. Arrangements for the holding of the conference which is primarily to be devoted to an interchange of views on the use of aircraft in commerce and industry are in the hands of a committee headed by Stuart Turner, aeronautical engineer, National Advisory Committee for Aeronautics.

University of Kansas Offers Aero Course

LAWRENCE, KAN.—The University of Kansas is now offering an advanced course in aeronautical engineering to senior students at the Department of Mechanical Engineering. Classes in aerodynamics and aircraft design are being given. Other courses will be added later. At present there are 14 senior engineers and two graduate students enrolled. Prof. Earl D. Hoy, who has made a number of years' experience in teaching aeronautics, is in charge.

Name Radio Station Director

WICHITA, KAN.—F. E. Robinson has been selected by the Department of Commerce as assistant in charge of the new radio station at the municipal airport here.

Trade Tips

As is reported that—

An airport is soon to be established on the Louisville Pike west of Independence, O., north of Cincinnati, with hangars, repair and supply equipment, etc. Two chase stations are being owned on the Western Hills Road by C. C. Coombs.

—Felix in Spain is very loudly toward American sports products and the improvement in quality by the firm, recently Chairman of Congress of America, that manufacturers should develop in this field, especially with reference to military work.

—The San Francisco American Southern Corp., in which J. B. Gilbert, 405 Vermont St., San Mateo, Calif., is interested, is now in process of plans for an airplane and accessory factory at San Mateo.

—Plans for the construction of a \$200,000 building for hangar, repair shop, service shop, and other are announced by the Wadsworth Municipal Airport.

—The authorities of Clayton Airport, London, are in process of securing foreign designers of equipment for airport lighting. Address Office in Clayton, London Airport, Clayton, England.

—Bids are being received for the construction of a \$100,000 hangar at the Illinois State Corp. Field, Duane, Ill. It is a 100,000 sq. ft. hangar for the corporation.

—Landing, Texas, is to be a local proposition for the establishment of an airport on a 304-acre tract. The land would include construction of hangars, building of runways, etc.

—An airplane landing field and pole ground is planned by the Wadsworth County Club, La Grange, Mo. There are 300 acres in the club property.

—The city council of Santa Monica, Calif., has approved plans for the erection of two hangars, 300 x 135 at Olsen Field Municipal Airport.

—Airports are planned by Phoenix, Ariz.; Denver, Colo.; Hot Springs, S. D.; Beaver Dam, Wis.; Thompson, Ind.; and Storm Lake, Ia.

—George Loomis of Whittier, Calif., plans the construction of a five-room frame hangar, 98 x 20, two frame offices, and other buildings.

—Plans are being made for the erection of a hangar at Glens, Wyo., according to H. J. Jones, N.A.A. member there.

—Sheldon, Mo., has named a chamber of commerce service committee to locate a suitable airport.

AIRPORTS AND AIRLINES

Start to Develop Cincinnati Field

Plan Indicates That Completed Airport Will be Among Largest

CINCINNATI, O.—The city's plan for the development of its municipal airport indicates that the completed field will be one of the largest in the country. Comprehensive study of other airports by city officials and architects preceded final decision.

The happy results of three airport studies of the former field, 20 x 100, first the post office in the first great advantage the city enjoys. The land lies at the confluence of the Little Miami and the Ohio rivers. Lambert Airport, as it was called, is about one-third the size of the new city airport.

Construction is being started on the land along the Little Miami. This day will prevent flooding up to a 10th stage of the Ohio River.

The deed of gift from the Lambert Airport Co. to the city required that \$600,000 be spent in improvement within 60 days. The city has voted a \$500,000 bond issue for development of the property.

The accompanying picture shows the proposed complete development of the field. An operations office with check-in, customs, the administration



A layout drawing of the proposed Cincinnati airport, showing location of hangars, administration, and school buildings.

Uniforms for Field Personnel

LOS ANGELES, CALIF.—The buying that the appearance of field personnel has undergone upon prospective patrons. Jack C. Jones, president of the Aero Corporation of California, has purchased all members of his field and flying organization to wear a uniform, consisting of black shirt, black trousers, and equipped riding breeches, while on duty at the airport.

building, a public address system will be installed for the use of the municipal office at the airport of the field. The Aero Corporation, a restaurant, dining room, retail store, etc., will be housed at this building. Hangars and shops will be located along the western edge of the field. All of these buildings will be surrounded by a hard surfaced apron.

Landing stadium will be spaced along a 100-ft. concrete apron, and it is believed that the dust and noise of today's average airport will be eliminated. In this respect, Lambert Airport is fortunate in having a heavy layer of black gravel soil.

Robert N. Otto, director of service of Cincinnati, is in direct charge of preparation of the airport and will be the city's official representative when the field dedication ceremonies are held.

Cotton Dusters' Season Closes

Texas Company Ends Fourth Year

HOUSTON, TEX.—Phon Lewis Moore and Vance Hartman, J. J. Stewart Duster, general work, attended Model Texas dusters, have returned in Houston, Texas, to close the cotton duster season for the year. These planes are from the fleet of eight cotton dusters, purchased by Texas Aero Dusters, a Houston company, owned by Capt. J. C. Taps, Jr., and T. C. Brown, Jr.

During the season just closed, what started in June, these planes duster 25,000 acres of cotton in bulk, several times, and several of 400 tons of cotton are duster. The cotton harvest had been three and one-half applications of poison of six pounds per acre.

During the season is done by flying a specially designed and constructed plane, equipped with a heavy tank, holding 100 lb. of the poison, very low over the fields, gently rolling the wheels on the tall stalks of cotton and discharging the poison through a narrow chute into the cotton at the bottom of the tank and through a spray-gun-like device into the cotton stalks.

In speaking the season just closed, Captain Taps stated that the operation this year was much more successful and profitable than in any of the three previous years. This has been due to the close of work.

Dallas Reports Plans For New Air Lines

DALLAS, TEX.—An agreement has been made of a new air line between Dallas and Wichita Falls. The agreement is being by December 1, 1938, by the co-termining company in Wichita Falls, Parker Airline, Wichita Falls, a president of the new company.

The American Air Transport Co., in Dallas, headed by C. E. Freeman, has announced arrangements of service over a line from through Wichita Falls, Texas, which will be 28 days, which will be service over the line between Wichita Falls.

Installs Cedar Rapids Lights

CEDAR RAPIDS, IA.—The lighting system for the new Cedar Rapids, which was installed by the Cedar Rapids, has been delivered and a new letter installed.

Fenestra Hangar Doors

HANGARS AT many of the large airports are now equipped with Fenestra doors made by the Detroit Steel Products Co., 2250 East Grand Boulevard, Detroit, Mich., and many airport operators and contractors are taking advantage of the engineering advisory service maintained by the company. Sales and erection organizations, con-



A typical Fenestra installation showing doors rolled around corner to position along side walls.

Tabed in all of the larger cities, are available for immediate service.

Fenestra doors are built entirely of steel and aluminum has been made to fill two-thirds of the door area with steel mesh for glass. Special weathering paint construction is employed in the arch portion of the door in such a way that 80 per cent of the steel in each bar is retained. Thus the mesh cannot be made to offer great strength with slight bulk and consequently small pieces of glass may be used for the admission of daylight.

The doors are made in units and may be so installed as to roll around corners to an out-of-the-way position parallel to the end or side walls of the hangar. Each unit is carried on large ball bearings which roll on steel tracks. No secondary rollers are used in the installation.

By using weathering strips at the joint and by overlapping angle guides at the top and by close contact of panel joints with guide rails in the bottom, Fenestra doors are made weathertight. They are fire proof and provide an effective barrier against the spread of fire. These doors are manually operated and, besides being constructed, their use permits savings in hangar construction.

Biltmore Seat Covers

SEAT COVERS for airplanes are now being made by the Cincinnati Auto Specialty Co., Cincinnati, O., and one of their first orders was supplied to the International Aero-Vent Co., Kansas, O., for one of its five passenger planes. Biltmore seat covers were developed by the company to provide a means of protecting upholstery in plants from the dust and dirt of fabric and to prevent a destructive appearance.

These covers are made of Biltmore Aircraft cover fabric, tailored to fit, and are intended for long life and hard usage. The material used is durable and of attractive design.

Oxweld Shape Cutter

PRODUCTION COSTS are being cut in many plants by using the automatic oxy-acetylene shape cutting machine introduced recently by the Leeds Air Products Co., 30 East 42nd St., New York, N. Y. This machine is designed to cut shapes of any sort from steel plate, sheet, forgings, billets or ingots. The parts are steadily built without impairing the delicacy of adjustment necessary in a precision instrument of this sort and the design and construction is such that accurate cutting is obtained by the elimination of lost motion.

In this machine the cutting blowpipe is mounted on a carriage which is moved in any direction by means of an electric motor. For routine production it will operate automatically from templates. In cases where only a few parts are to be cut a hand tracing device can be attached and used to follow the outline of a sketch or blueprint.

The Oxweld shape cutting machine requires but one operator. Little machining is necessary in most



Use of oxweld shape cutter showing how circles of various sizes can be cut from templates.

cases after cutting because the parts are produced with straight cut and smooth faces. The speed of cutting is very high and ranges from 3 to 20 in. per min., depending on the thickness of the metal. Accurate and smooth cuts can be made in stock up to one foot and more in thickness.

The Cierva Autogiro

(Continued from page 1217)

as the blades should only be able to maintain rotation in the wrong direction, that is should make the blades move trailing-edge forward. Actually if the blade system is at rest under the sole reflexion of such air flow the secondary would be to cause rotation in this reversed direction and it is necessary to give to the blades an initial impulse to secure rotation in the required sense. Therefore that rotation is maintained by the air-flow. The reason for this apparent anomaly is a little difficult to put into simple terms, but it may perhaps be explained by analogy with the wings of an ordinary airplane gliding with engine shut off.

The total resultant force on an efficient airfoil at incident angles of attack is inclined forward of the normal to the chord of the airfoil, but backwards to the direction of the relative wind. In a horizontal wind this total resultant, therefore, is inclined back from the hori-

zontal, and as horizontal flight there is a drag component clinging for a thrust force to balance it. If, however, the relative wind has an upward component the total resultant force on the wing may be shifted forward until it is vertical, though it is still backward relative to the wind. The airplane may then glide horizontally, without any thrust being applied to it.

In the Autogiro the backward tilt of the arc about which the blades rotate causes that the rear portion of the blades shall be similarly tilted relatively to the wind and therefore that the total resultant force on the blades may be inclined relatively to the axis in a direction tending to accelerate and not retard the rotation at low rate of revolution. As the speed of rotation increases the direction of resultant force will approach more and more nearly to parallelism with the axis, until at some speed this resultant is actually parallel to the axis.

Apart from the friction of the bearings there is the assumption on the system, which will continue indefinitely to rotate at this particular speed. As a measure of rotation will at once cause a retarding, and a full accelerating torque, so that the rotation is stable.

owing to the complicated movement on the blades composing the rotating system a steady condition of zero torque for each blade cannot be attained. Each blade alternates between maximum positive and negative torque in the condition of flight the mean sum of all the torques on all blades becomes zero, and the system is in equilibrium at some speed of revolution which is determined by its particular aerodynamic characteristics.

Speed of Vane System Constant

Apart from a secondary effect caused by the induced inflow into the blade system the speed corresponding to zero mean torque is constant for constant thrust. The thrust must balance the weight of the machine in flight and therefore the rate of revolution of a given Autogiro vane system in flight is, to within small limits, constant and independent of the precise conditions of the flight.

Mathematical methods of dealing with the aerodynamics of the Autogiro have been developed in England by Messrs Cierva and Lock* and published by the British Aeronautical Research Committee, and these may be consulted with advantage for those who desire a detailed analysis of the very complicated phenomena of this type of aircraft. It is, however, only fair to state that these investigations depend on a number of simplifying assumptions which are open to question, the results are not widely accepted by some who, and they seem to be a variance with the observed performance.

The most recent type of Autogiro as yet manufactured by the Cierva Autogiro Co. Ltd., known as the Type C16 Mk II and is shown in two of the accompanying illustrations. This machine has a standard airplane fuselage skeleton, except for a few minor modifications, with that used for the well-known Avro Type 504 two seater machine extensively used for training and other purposes in England. Attached to the fuselage at the rear end above the front cockpit is a pyramid of streamlined steel tubes which support the upper end of the slightly inclined mast which passes down into the fuselage. This lower end of the mast is fitted with a series of steel gear by which the mechanism of the mast is driven. The mast is in flight to obtain the best lateral trim. This control is desirable because there is a lateral force on the rotating vane which changes in magnitude and direction with change of speed.

Running on the mast above the pyramid is a steel block

*S. B. M. No. 111. A general theory of the Autogiro. By H. Cierva, M. A. B. S. No. 117. Further theoretical treatment of Autogiro Theory. By C. S. Lock, M. A.

supported on ball bearings of the combined thrust and normal type. This block is anchored to form four legs which carry roller bearings for the vanes hinges at the blade roots. The axis of these vanes hinges are horizontal. Each of these legs is enclosed by a light spider which carries a horizontal hinge pin and is provided at the outer end with a vertical governor-spring loaded hole. A second fork carries a pin passing through this vertical hole and a device to which the rest of the block, spurs are fastened.

There is thus a double hinge, or universal joint, between the blade and the central hub-block. The object of the second hinge is to prevent transmission to the hub and the rest of the fuselage caused by the rapid variations of torque which the blades continuously suffer. Folding backwards of the blades about this hinge is provided by



A Cierva Autogiro in flight over the Teufelsdruffer airport at Berlin, Germany. The other aircraft shown are two Junkers.



A Cierva Autogiro in flight over the Teufelsdruffer airport at Berlin, Germany. The other aircraft shown are two Junkers.

interconnecting each blade to its neighbor on either side by cables attached about halfway in along each main spar. These cables are rigged a little slack and each is loaded centrally with a lead weight.

When the blades are rotating centrifugal force on these weights pulls the cables outward and keeps them taut. If the torque on each blade were exactly the whole system would then rotate uniformly. As the torque on each blade is continuously varying the individual blades will change their relative positions by slight angular movements about the secondary (normal) hinge and the other side hinging and twisting of the cable on the interconnecting cables. The torque variations are then absorbed in alternate acceleration and deceleration of the blade mass and so forces due to this unbalanced torque are transmitted to the control hub.

The blades are each built on a single tubular steel spar with spruce ribs. From leading edge to spar the covering is three-ply. At the rear end of each spar is a flange to mate with that on the fork of the secondary hinge. At the outer end a steel on the spar carries an adjustable lead weights used to secure dynamic and static balance of the blade system.

Each blade is tapered in plan both towards the center and outwards to the tip. The inner third of the blade is

The SENIOR AIRSEDAN



EIGHT PLACE—DUAL CONTROL

Specifications

Weight Empty	3,600 lbs.
Wing Area	19 sq. ft.
Wing Area	422 sq. ft.
Length	31 ft. 6 in.
Useful Load	3,000 lbs.
Seating Capacity	8 Passengers

Performance

High Speed (On Level)	110 m.p.h.
Cruising Speed	118 m.p.h.
Landing Speed	40 m.p.h.

Power Plant

Engine	Waco
Horsepower	431
Fuel Capacity	140 gals.
Oil Capacity	11 gals.

Equipment

Stinson, Bader, Wood, Penfield, Cessna, Air Speed Industries; Navigation Lights; Tailwheel; Altimeter; Clock; Six Instruments; Fuel, Oil Pressure, and Oil Temperature Gauges; Air Corps Theodolite; Stinson and Prof. Value; Exhaust Valve; 504; Cabin Heater.

Price, \$18,500

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MARYSVILLE, MICHIGAN

AVIATION
October 27, 1938

merely a barrier for the spir as this section is incapable of producing thrust except as return for excessive torque. The working section is set at a pitch angle which increases progressively outwards from 0 deg. to 4 deg. at the tip.

It should be emphasized that the centrifugal loads on the rotating blades are of the order of ten times the lift loads. The main intake spar is therefore essentially a tension member, and subject only to minor and secondary bending stresses.

To the bottom of the fuselage, below the main there is attached a small wing braced by struts whose purpose is to carry a set of ailerons. These ailerons serve primarily



A front quarter view of the Curtiss Autogiro, type CSD. This is an earlier model than the type C&M II, and has no ailerons.

the same purposes as those of the ordinary airplane. The rest of the machine is also similar to the normal airplane. Except that a specially wide track undercarriage is fitted, and that the elevators have been enlarged and fitted with hinge balances, the whole is composed of standard Aero Type 304 airplane components. An Armstrong-Siddeley "Lynx" engine of 180 hp. driving a normal propeller provides motive power.

The operation of this type of aircraft differs little from that of the ordinary airplane. Having started the engine it is necessary to give the rotor a start in the right direction. This can be done by hand from either cockpit. If the rotor is then opened up and the machine tilted at 20 to 25 mph. for a minute or so, the rotating wings will accelerate to something near their correct flying rate. If the engine is then opened up fully the machine takes off just as does any ordinary airplane after a short run. In the air it is controlled by the normal airplane controls and precisely as they are normally used.

The machine appears to have a high degree of automatic stability, banks correctly and apparently spontaneously on turn, and for all practical purposes cannot be stalled. The qualification "for practical purposes" is introduced only because according to the manufacturer's deductions of certain British authorities the Autogiro should have a definite maximum lift and therefore a definite maximum speed at which it can be said to be stalled. Actual performance of these machines suggest that this stalling speed, if it exists, is much lower than the competition indicate.

It is certainly possible to make the Autogiro descend in an apparently vertical path in winds not exceeding four or five miles per hour. The machine is in complete control in such a descent, and its vertical velocity is low enough to allow the shock of landing to be absorbed by the undercarriage.

(Continued on page 1346)

AVIATION
October 27, 1938

MULTIPLE FEATURES

The response to the throttle—the quick takeoff—the life—the movement—the control at all speeds—the spirit—the color—the things you have always wished for in an airplane—all combined with safety and good looks * * * THAT is EAGLEROCK! * * * It possesses style—detail—finish—and the ability to stand up, day after day * * * EAGLEROCK is the standard of comparison in its class.

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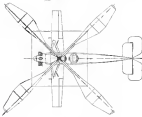


Trade Dress Registered

Normal landings are made precisely as with an airplane. The engine is throttled down, the stick eased forward, and the machine will then glide down and can be flutted out at the ground in the usual way. Any intermediate between the normal glide and the nearly vertical descent can be obtained by the use of the elevator. Quite steep descents are equally possible.

The machine is not adapted for stunting and it is a little difficult to conceive of an Autogiro looping, but for all straight-forward flying the machine is somewhat easier to handle than any airplane.

The performance of the Autogiro compares favorably with that of the normal airplane. The type with the 180 hp. Lyco engine has maximum and minimum speeds in



Plan, elevation and profile drawings of the Curtiss Autogiro Type C-8, Mk. II. These drawings show clearly the rotating mechanism and the construction of the mast which supports the system. The oval wing at the bottom of the fuselage, which carries a set of ailerons, is also shown.

horizontal flight of 105 and 25 m.p.h. The maximum forward speed in a glide is not more than 15 m.p.h. and the rate of climb is 500 ft. per min.

Further developments will doubtless lead to even better performance, but at present the Autogiro is definitely a safe, practical flying machine without the ordinary dangers of stalling.

The Autogiro Company is at present developing an auxiliary drive which will allow the spinning up of the rotating wings directly by the main engine. This arrangement will make possible a take off at least as good

(Continued on page 3350)

THE TABLE BELOW IS BELIEVED TO BE ACCURATE

Manufacturer	Model	Year	Engine	Power	Speed	Altitude	Range	Price	Notes
Adams Aircraft Co.	Model 10	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 11	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 12	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 13	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 14	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 15	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 16	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 17	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 18	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 19	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 20	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 21	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 22	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 23	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 24	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 25	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 26	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 27	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 28	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 29	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 30	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 31	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 32	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 33	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 34	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 35	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 36	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 37	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 38	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 39	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 40	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 41	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 42	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 43	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 44	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 45	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 46	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 47	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 48	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 49	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 50	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 51	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 52	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 53	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 54	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 55	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 56	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 57	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 58	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 59	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 60	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 61	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 62	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 63	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 64	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 65	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 66	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 67	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 68	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 69	1928	Continental 4	40	100	10,000	1,000	\$1,000	
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Adams Aircraft Co.	Model 80	1928	Continental 4	40	100	10,000	1,000	\$1,000	
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Adams Aircraft Co.	Model 85	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 86	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 87	1928	Continental 4	40	100	10,000	1,000	\$1,000	
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Adams Aircraft Co.	Model 89	1928	Continental 4	40	100	10,000	1,000	\$1,000	
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Adams Aircraft Co.	Model 96	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 97	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 98	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 99	1928	Continental 4	40	100	10,000	1,000	\$1,000	
Adams Aircraft Co.	Model 100	1928	Continental 4	40	100	10,000	1,000	\$1,000	

will appear monthly and corrections and suggestions are invited.

Level As Supplied by Manufacturers.					
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FURNACE AND MFG. CONSTRUCTION:		LIGHTS:		SHOCK ABSORBERS:		INSTRUMENTS:	
1-Boiler	1-By-product burner	N-No gas lights	Art-Air	P-Perimeter	Dr-Drum	D-Dynamometer	
2-Corrupted	2-Boiler	C-Cover	C-Cor	R-Rib	R-Race	R-Race	
3-Maintenance	3-Boiler	CONSOLE	C-Corruption	B-Race	B-Race	B-Race	
4-Fabric cover	4-Tank	A-Air	A-Air	A-Air	A-Air	A-Air	
5-Maintenance	5-Tank	C-Cable	C-Cable	C-Cable	C-Cable	C-Cable	
6-Vent system	6-Water	D-Dual	D-Dual	D-Dual	D-Dual	D-Dual	
7-Boiler	7-Boiler	D-Wheel	D-Wheel	D-Wheel	D-Wheel	D-Wheel	
8-Boiler	8-Boiler	P-Push	P-Push	P-Push	P-Push	P-Push	
9-Boiler	9-Boiler	S-Side	S-Side	S-Side	S-Side	S-Side	
10-Hydrolic	10-Hydrolic	T-Trial	T-Trial	T-Trial	T-Trial	T-Trial	
						TYPE CERTIFICATE	
						Approved for and is reading	
						GUARANTEE:	
						N-New	



EARL P. HALLIBURTON'S *Wasp-Vega*. An oil field service plane which won by a margin of over three hours the Class "C" Transcontinental National Air Race Event. Also winner of Closed Course Event No. 6.



MADDUX AIR LINES, Los Angeles, operate *Whirlwind-Vegas* for special charter trips to all parts of the United States. This is in conjunction with their daily schedule service in California and Mexico.



HARRY J. TUCKER'S "Yankee Doodle." A stock production *Wasp-Vega*. Holder of Los Angeles to New York and Los Angeles to Cincinnati non-stop record flights. Art Goebel, Pilot.



CAPT. GEO. H. WILKINS' *Whirlwind-Vega*, which carried him across the top of the world. The Hearst Wilkins Antarctic Expedition, now under way, is using this same plane and a new *Whirlwind-Vega*, both equipped with pontoons.

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to the distinguished names numbered among those who have purchased Lockheed Aircraft. These names constitute a silent endorsement more powerful than anything we can say. They show an undeniable preference by those who have staked their lives, their business success and their reputations on Lockheed monoplanes. All Lockheed accomplishments and performance records have been made with stock model planes privately owned.

facilities adequate time that available ance, craft Aircraft engine call Lockheed and ability

Commercial Airplanes with a F

Performance figures given below are made from actual full payload and are guaranteed to within plus or minus

Wasp-Vega

THE fastest five-place commercial airplane in the world. Performance comparable to that of the fastest single-seater pursuit planes. The choice of those who require maximum high speed without sacrifice of comfort or safety. Holder of Los Angeles to New York non-stop flight record, and many times a winner in National Air Race events. Action of ship in flight shows unusual inherent stability. Permanent alignment, perfectly steam-lined, and head resistance less than one-half that of conventional types. Delivery twenty-five days after receipt of order.

Top Speed	170 miles per hour
Cruising speed	135 miles per hour
Climb	1800 feet per minute
Landing speed	55 miles per hour
Pay-load	1000 pounds
Cruising range	750 miles
Fuel consumption	8 miles per gallon

Wasp-Air Express

A SEVEN-PLACE monoplane with 1000 pound pay-load. Designed and built to meet the most exacting requirements for passenger and express service. Folding seats allow all or part of six passenger cabin, instantly converted into cargo space. The model the pilot occupies an open cockpit at rear of the cabin. His seat is adjustable to any desired elevation, and the parasol being mounted on short struts above the fuselage allows him unlimited vision in all directions. The high cruising speed of the *Wasp-Air* and its extremely low cost of operation per passenger mile flown mean greater service to the public and greater profits to the operator. Performance is approximately the same as given for the *Wasp-Vega*. Delivery forty days after receipt of order.

Valuable sales franchises are being allotted to corporations and individuals. Some of the very best

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 Venice Boulevard at Figueroa
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Increased production
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 financing enable us to announce for the first
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 for prompt delivery. Supreme in performance,
 craftsmanship, comfort and beauty, Lockheed
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 engine transport. Experienced pilots prefer the
 Monoplane for its vision, ease of handling
 to get in and out of small fields.

Fighting Performance!

fuel tank with
 500 gal. per hour

Whirlwind-Vega

LUXURIOUSLY appointed cabin comple-
 mented with comfortable accommodations for four
 passengers, baggage and pilot. The same sturdy
 plane with instruments that earned Capitan
 Williams a name as the top of the world. Whirlwind
 and name elevated to a remarkable degree by
 its unique four-engine construction. A favorite
 with operators, pilots and passengers. No less
 than 220 h.p. Whirlwind engine cranks out
 of many planes, using 210 h.p. Vap for the
 same pay-load. Delivery within days after
 receipt of order.

Top speed	320 miles per hour
Cruising speed	110 miles per hour
Climb	1000 feet per minute
Landings	20 miles per hour
Pay load	2000 pounds
Cruising range	1000 miles
Fuel consumption	30 miles per gallon

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 territory is still available

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 Offices and Airport are located
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STANDARD OIL COMPANY OF NEW JERSEY has equipped Vega Vega for transportation of officials and inspection of holdings. The familiar Standard Oil color combination is carried out with red fenders, white wings and blue lines.



SANTA MARIA AIRLINES, Santa Maria, California operate Whirlwind-Vegas. G. Allen Hancock, President of Santa Maria Airlines, is the man who led the flight of the "Southern Cross" to Australia.



THE TEXAS COMPANY, New York, operate "Texaco No. 2" a 4 Whirlwind Vega, in the sales and advertising of their well known "Texaco" petroleum products. Frank Buckles, Chief Pilot.



WATSON AIR EXPRESS, Los Angeles. Watson air mail pilots and operators have contributed valuable suggestions to the design and construction of the Vega Air Express, a seven-passenger mail and passenger transport with 1500-pound payload.

AVIATION
 October 27, 1938

13-97

WINTER KING FLYING SUITS Built for Warmth

Luxurious flying suits made of the finest materials available, tailored by master craftsmen to the tastes and requirements of the flying fraternity, and at remarkably low prices not to be equalled elsewhere.

\$29.50

Entirely lined with warm wool felt.

\$35.00

Lined with best grade virgin wool.

\$39.50

Lined with heavy yellow sheepwool.

\$49.50

Lined with the luxurious long nap Peruvian Alpaca wool. A revelation in lightness and warmth.

All sizes from 36 to 46

Read these specifications and compare

Genuine gaiters for their sleek, smart, well-known felt boots, superior fly caps, all pieces of wear are hand-made, legs are made to order to suit you and make any possible winter clothing for winter 1938-39.

style and comfort. Heated fasteners, two large breast pockets, adjustable wrist straps, two convenient hand pockets and also two hip pockets. Heated fasteners at leg bottom.

An exceptional money making proposition for doctors, schools and others.

Write for offer

AIR TRANSPORT EQUIPMENT, Inc.

Curtis Field, Hangar 20-A
 Garden City, N. Y.

Address wires
 via Hempstead

Phone:
 Garden City 6666

THANK YOU for mentioning AVIATION

(Continued from page 1344)

as and perhaps better than that of a similarly powered and equally loaded airplane.

The company is also able to place on the market a machine known as the Type C17 to compete with the very popular class of two-seater light airplanes now built in England. This machine will be fitted with the four-cylinder air-cooled 75 to 80 hp. Cirrus Mark II engine, and will carry a crew of two with ample baggage accommodation and three hours' fuel supply. The speed of this machine will be 90 m.p.h., with a maximum speed far lower than that of any airplane of equivalent type, and an approximately equal climb.

This machine except for the rotating wing system will be mainly built up from standard components of the well known Aero-Aero light airplane. The greatest development of the Aviaton has been carried on by the Carter Aviation Co. in conjunction with A. V. Roe & Co., Ltd., which accounts for the fact that standard detail construction due to this firm enters so largely into the machines described.

Commander Byrd's Fokker

(Continued from page 1325)

With the cabin tank installed, there is ample room for several passengers besides the pilot and mechanic. The tank is installed in a deventable cradle to permit easy removal when the full freight and passenger capacity is to be used. Ample space is provided for carrying loose five-gallon fuel cans. An oil tank, having a capacity of 15 gal., and an expansion space of 20 per cent. of its volume, is placed under the pilot's seat and

also can be filled while the plane is in flight. This tank is air cooled having inlet and outlet connections to the air stream. In the rear of the cabin on the right side is an opening 18 x 24 in. in the floor ordinarily closed by a trap door. In front of this opening is mounted a bracket on which the drift indicator can be mounted. Directly above it is the ceiling of the cabin in spooling opening through which the navigator can put his head and shoulders to obtain a view in all directions for instant observations.

No Fire Wall in Byrd's Plane

Another outstanding difference between The Virginia and the commercial Super Universal is that the Byrd plane is short-coupled, that is the distance between the engine and the wing is eight inches less than in the production plane. This is accomplished by extension of the fire wall between the motor cowlings and engine compartment. This provides greater warmth for pilot and mechanic and ease of access to carburetor, pump and magnet. Additional warmth and ventilation is supplied by the cockpit heater, which has its outlet directly in front of the pilot's seat. A high-pressure type Pyrene fire extinguisher system is installed to compensate for the elimination of the fire wall.

The Pratt & Whitney Wasp engine of the series develops 450 hp. at 1,900 r.p.m. and is equipped with a new type of auxiliary heater, through which hot air from the area surrounding the exhaust is carried to the air intake. The heater is regulated by a manual control. Together with the standard adjustable bleed cooling, the heater provides the correct temperature for efficient operation of the power plant.

Instrument installation is complete. Nothing, contributing to safety for flying under adverse conditions,

On the airways of the country

A GAIN reliable reports reveal that at least 85% of the plywood wing commercial airplanes operating over U. S. Airlines are built with HASKELITE.

Although reports from some of the smaller companies are not available, definite records

HASKELITE Users

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Continental Airlines
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Eastern Air Transport
Colonial Western Airways Inc.
Pacific Air Transport
Western Air Express
New York City & New York
Midwest Airways
TWA Air Transport
Transcontinental Airlines Corp.
West Coast Air Express
United States Air Transport
The
Super Airways Company

Continental Airlines to Airlines
Frontier Airlines, Inc.
Continental Air Lines, Inc.
National Airlines Corp.
Boeing Air Transport
Colonial Western Airways, Inc.
Western Airways, Inc.
Midwest Airways
The
New York City & New York
Midwest Airways
TWA Air Transport
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AS EXPERTS SEE US

J. Warren Smith, McKeanport, Pa., nationally known air mail and transport pilot, passes judgment on the Travel Air Cabin Monospace.

When J. Warren recently visited the Travel Air factory to take delivery of two Travel Air planes for mail service on the Ball Air Mail line, he had his first chance to thoroughly inspect, test and fly a standard production Travel Air Cabin Monospace.

And this is what he said:

- 1—The most wonderful control in a "Biplane" is found in this Monospace as in all Travel Air airplanes. This is especially noticeable on a Monospace. There is plenty of "batter" when you want it.
- 2—Has the most wonderful load factor and takes off as in all Travel Air. Load it down, get in the air and you don't know you have a load. Take off and landing ability in small fields truly remarkable.
- 3—Construction gives complete protection, such as landing gear parts which have bearings and hollow bolts for Aluminizing. Severe stresses are protected. Give me landing gear inside for the price of a 15c landing. All control parts constructed for ease of inspection.
- 4—Landing gear light constructed on red and white lights to prevent confusion and to prevent collision. Landing gear is not like the ball and bearing, at least the ball is in the air which it should go.
- 5—One section of wing ribs of wood 100% glass is especially desirable to hold an airplane. There is any change in wing curve due to change.
- 6—All main, tail and screen placed to prevent mist.
- 7—Cap strips in wings put on with screws to allow for vibration and not stuck through frame.
- 8—Lots of "Duper" around the Travel Air factory. Don't think we only fly to fight and battle but to keep them tight all the time.
- 9—No hammer or chisel marks anywhere. A finished job in the heart of workmanship.
- 10—Cabin built with consideration of comfort of passenger. They fly the aircraft.
- 11—Pilot's seat so comfortable can fly for 4 to 5 hours without getting tired.
- 12—Engineers built into every detail even to a smaller step case right at the pilot's seat.
- 13—"I have never seen anything get out from a Travel Air but that was in love with it, an evidence of my love."
- 14—"A lot of people all praise because of safety and dependability are incorporated in this new Travel Air."

See Travel Air makes right types of airplanes to fill every commercial need on



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As most garages on many airports will be moved closer to the cities, also there will often be such places where it is advisable to change the location of hangars or to enlarge them. It is therefore of the utmost importance for hangars to be of such construction that they can be taken down and re-erected without loss of material and at a minimum cost of labor.

We ship to you a complete building with steel wall sections with rock and galvanized sheet already riveted to them, with trusses, rafters, braces completely fabricated, so that the building can be quickly taken together (without any field riveting) with unskilled labor, about 30% increase work already done in our shops.

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AVIATION
October 25, 1928

(Continued from page 1354)

Service ceiling . . . 12,000 ft.
Fuel consumption . . . 125 gal. per hr.
Oil consumption . . . 125 pt. per hr.
Take off on dead calm within . . . 200 ft.
Land on dead calm within . . . 150 ft.

True Altitude Meters

(Continued from page 1323)

meter along the length of the wire is always the same as are the distances between O, WW, XX, YY and ZZ. The early attempts endeavored to make use of this portion of the wave between O and WW, and chose a wavelength of about 8,000 ft. A small transducer reduced the wave which, after reflection from the earth, was picked up by a receiver connected to an indicating device. If the airplane were at an altitude of 2,000 ft. a maximum deflection was expected to be obtained on the meter, as 1,000 ft. a predetermined lesser deflection, and so on. It was found at the time that most of the wrap-around vibrations were obtained because, we now know, that it is virtually impossible to obtain reflections of long radio waves.

The experiments along these lines were persisted to have until comparatively recent times when the advent of short waves, which are readily reflected, gave new impetus to the development of a standing wave altimeter. A short wave transducer, collector and indicator is now being investigated. While good reflections are obtainable a new problem has been considered. As shown in (a) of Fig. (2) the distance O-XX now approximates 300 ft. while the quarter wave is only 25 ft. Hence the present practice is to rely on observing the points of maximum and minimum readings, disregarding the intermediate variations. Because signals have shown that marked peaks and valleys can be obtained corresponding to the nodes and antinodes in the standing wave.

There is no longer any question but that this method will determine directly what the aircraft passes through a node of antinode of a standing wave. There is doubt, however, as to the manner by which it will be possible to identify which particular node or antinode is being passed. Obviously it helps but little for the pilot to know that he is 25 ft. lower or higher unless he is accurately informed as to his previous altitude. A possible solution lies in the fact that, as the altitude increases, there is a corresponding decrease in the amount of deflection between maximum and minimum. It is now contemplated that the indicator shall be calibrated in terms of maximum intensity which should considerably assist in the determination of actual altitude, especially when flying over an area having uniform reflecting properties. The value of an automatic calibration when over land with all the varied reflecting factors represented by buildings, trees, etc., is doubtful.

The solution of the altimeter problem by some modification of the standing wave method is being thoroughly investigated by competent research workers. They are handicapped by the limited knowledge which now exists concerning the properties of radio waves. Should their present efforts prove fruitless it is not improbable that the future may bring forth new means for the application of standing waves in the determination of altitude.

A second type of electric altimeter is called the Capacitance Altimeter and is based on the principle that the capacity of an electrical conducting system changes with any change in the relative position of the parts in the system. The specific idea of using the change in capacity as a measure of the altitude of an aircraft appears to have originated in England ten or twelve years ago, though

AVIATION
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many people in this country independently suggested the same idea.

Referring to Fig. 3 (a), X and Y are two plates mounted on the aircraft and connected to measuring device Z. The dotted lines represent the capacities which exist between the plates and ground. Fig. 3 (b) shows the equivalent circuit and indicates more clearly how the distance of X and Y from the third plate or ground may have an appreciable effect on the capacity between X and Y. Perhaps none of the true altimeter methods looked so simple and practicable on paper as did this one. Various schemes were evolved to measure the changes in capacity, among them being the heterodyne beat, resistance and simple bridge methods. The results were markedly variable. Some investigators reported success at great altitudes, others conservatively estimated the maximum altitude measurement possible to be not over 10 ft., while a third group found that the instruments gave reliable indications only when the tail fin was touching the ground. The extraordinary diversity in the results led to more careful research into the fundamentals of the altimeter. The reason for the apparent success of several capacity altimeters was soon discovered. They were functioning at high altitudes but were not measuring the capacity change between X and Y due to the position of the ground but were measuring the change in capacity due to variation of the dielectric constant of the air. To explain—the capacity of a condenser is a function of the material between the condenser plates, and if the material

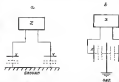


Fig. 3. A diagram of two equivalent circuits, showing the capacity effect between the metal plates and ground.

varies, the capacity varies. As yet becomes more needed at the higher altitudes it follows that the capacity of the condenser formed by the two plates as shown in Fig. 3 will change in proportion. Since the density of the air is a function of the barometric pressure, the supposedly successful altimeters were merely electric barometers, with the limitations of electric measurement added to barometric variations. Having demolished the hopes of the apparently successful workers, investigators next turned to the failures. Here, too, the answer was relatively simple. Models had been built, usually, before a careful analysis had been made, and on the assumption that the capacity changes involved were relatively large. Actually the capacity variation to be measured was extremely small—measurable, but only by the finest of the laboratory instruments then available.

It was at once obvious that the success of the capacity altimeter depended on the development of an entirely new technique which would permit precise measurements under service conditions.

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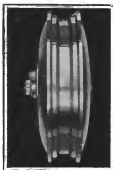
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SIDE SLIPS

By ROBERT R. OSBORN

As there are probably quite a few readers of AVIATION who are not also readers of the Hearst newspapers, we had better make the announcement that a large dirigible, named the "Graf Zeppelin," arrived at Lakehurst recently after a 111 hr. flight from Germany.

* * *

The German crew of the Zeppelin are making a considerable fuss over the fact that a horizontal control was damaged during the flight and was repaired in the air by four members of the crew. We refuse to be impressed or "het up" over this news, however. Haven't our own California fliers been repairing landing gears, overhauling motors and changing propellers in flight for years now?

* * *

Envelopes bearing four mark stamps which were carried over on the dirigible have now risen in value and are selling for three dollars each. The Intrepid Aviator says he supposes this is because it took the ship so long to get here that the stamps now have an antique value.

* * *

We take the liberty of reprinting the following excellent comment from the "Left at the Post" column in the New York "Evening Post," the editor of which, Mr. Russell Crouse, is so enthusiastic over the Zeppelin flight that his friends assure him he has become "lighter-than-air minded." He says, "No smoking was permitted on the Graf Zeppelin, possibly because blindfold tests interfere with steering."

* * *

The newspapers say that there was no liquor on board the ship when it was inspected by our customs men, whatever liquor was on board having been consumed before the trip was half over. We're not pointing out any connection between the two items, y'understand, but just about in the middle of the trip was when the ship left off its erratic course and started coming straight for Lakehurst.

* * *

We'd like to inquire if the reporter for the New York "Sun" was directly quoting the naval officers when he wrote his copy: "Following a superficial examination of the damaged fin of the ship naval officers said that it would take from six to eight days to repair it. The fabric must undergo an intricate process of preparation before it can be fitted to the framework."

* * *

It would be interesting to learn the final outcome of the business venture of a bus driver in Times Square, New York. K. H. saw his bus there two days before the ship arrived, with the sign on the side, "Round trip to Lakehurst and return, \$3. See the Zeppelin arrive." K. H. found on inquiry that the driver was going to Lakehurst as soon as he got a load and would stay there until the dirigible had landed.

* * *

A good conception of how much the uncertainty of news from the dirigible and the delay in her trip upset the plans of the reception committee, can be gained from the report that four hardy gardenias wilted into eternity on the coat lapel of Mr. Grover Whalen, the ever-present and ever-immaculate official greeter of New York City.

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